ROYAL BOTANIC GARDENS, KEW.

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IV.—DIOSPYROS EBENASTER.

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Diospyros Ebenaster, Retz. is a widely cultivated tree, and is recorded from various botanic gardens in different parts of the world, but the information concerning its natural habitat is often contradictory and apparently inexact or incomplete. The object of these notes is to attempt to remove the confusion which has naturally arisen from such conflicting data, and to determine if possible the natural home of the plant.

Blanco in his "Flora de Filipinas," p. 211, says that the plant is indigenous to the Philippine Islands, but that the Indians cultivate it. Merrill, however, writes on the label attached to his specimen 3800 from Manila (December 17th, 1903), "Cultivated only in Philippines, Blanco to contrary notwithstanding, and now rarely found." The same authority, in his recent "Flora of Manila," p. 364, states that the tree is rarely cultivated and only of local occurrence in the Philippines, adding that it was "introduced from Mexico at an early date, and apparently formerly much more common than now." Hiern in his monograph of the *Ebenaceae* follows Blanco and quotes the following:—"Philippines, *Sonnerat, Blanco;* Celebes, *Jacquin;* Amboina, *Rumph.*," adding, "Cultivated in Mauritius, at Calcutta, and Malacca, *Maingay* 975. Occurs also in cultivated places in tropical America, perhaps introduced." As we have pointed out, Merrill states that Blanco is wrong, while Koorders does not record the plant from Java or Celebes. We may note that Jacquin in "Hort. Schoen.," vol. iii. p. 35, is not very explicit as to the locality of the plant, saying only, "Crescit in insula Celebes. Culta in insula Mauritii." Rumphius is more definite; he says that it is "rare in Amboina, only one here and there in the region of Hitoe and in Banda, but frequent in Ceram and certainly in Bonoa; likewise in Sumatra round Jamby." From this it would appear that the tree is a native of these islands. The plant, however, which Rumphius figures and calls "Hebenaster" is reduced by Miquel in his "Flora van Nederlandsch Indië," vol. ii. p. 1047, to *D. Ebenum* Retz. (which, by the way, should be *D. Ebenum* Koen., as Koenig described it in

(3706.) Wt. 225–595. 1,125. 3/15. J. T. & S. G. 14.

1776 and Retzius in 1789). Further, Miquel makes no mention of *D. Ebenaster*. Rumphius gives various vernacular terms applied to "Hebenaster" by the natives of the different islands—a few of these being *Ahuelloe*, *Gamomong*, *Lolin*, *Lorin*, all of which, according to Filet, are popular names for *D. Ebenum*. Lastly, if we take Rumphius' description and figure, we find that they agree more closely with *D. Ebenum* than with *D. Ebenaster*, notably in the leaves being acute at the apex and having on their under surface a few hairs at the bases of the nerves. It is evident, therefore, that Rumphius' plant is *D. Ebenum*, Koen.

With regard to Malacca, Maingay's specimen 975 bears a note in pencil to the effect that the plant is cultivated, while *Loher* 407 is from the Botanic Garden at Manila.

The bulk of the evidence, then, points to *Diospyros Ebenaster* being introduced into the East Indies. The earliest record of the plant is apparently that of Sonnerat, who found the tree on his visit to the Philippines, and described and figured it in his "Voyage à la Nouvelle Guinée" (pp. 45–46, tt. 14–16), published in 1776. That the tree in all probability was introduced before this date is credible, for the Philippines were kept in close touch with Mexico and the West Indies by means of the Spanish galleons which plied the Pacific regularly from the late 16th or early 17th century up till the beginning of the 19th century. This period was one of great commercial activity among the Spaniards, and various authorities tell us that many trees and shrubs (mostly of some economic value) were introduced into the East Indies from Mexico and the Spanish islands of the West.

Urban in the "Symbolae Antillanae," iv. p. 485, is apparently convinced that the tree is a native of the West Indies, and gives its locality in the Antilles as "Prope Toa-Alta in montibus; *Stahl* 872." The fact that the plant was found growing in the mountains would appear to be conclusive. Urban also gives the following localities, "Cuba, Monserrat, Guadeloupe, Dominica, Mexico, Brasilia, insulae Malayanae," and adds on the authority of Duss that the tree is certainly indigenous to the Antilles since it was found growing in the woods in the interior of Guadeloupe. Duss' discoveries leave us in no doubt whatever, for he found the tree in various wild places. His own words are, "Assez abondant dans les bois du massif du Houëlmont, plus rare dans les bois des Bains-Jaunes et du Gommier; se rencontre aussi dans les hauteurs de Bouillante (Trou au Trois-Diables), et dans les bois inférieurs de la Pointe-Noire (No. 2573): Il n'est pas à la Martinique."

Unfortunately, the American material of *Diospyros Ebenaster* in the Kew Herbarium is somewhat limited. Of the specimens from Mexico, *Botteri* 909 from Orizaba would appear to indicate that the tree is native there—but Bourgeau's specimens 1823 and 2327 from the valley of Cordoba are cultivated (on the authority of Hiern). Urbina, in his catalogue of Mexican plants, makes no mention of the tree, while Sessé and Mociño in the "Plantae Novae Hispaniae" (2nd ed.), p. 166, and also in the "Flora Mexicana" (2nd ed.), p. 237, speak of it as *Diospyros Tlilzapotl*, and

give its habitat as "in calidis Novae Hispaniae regionibus." Their description of the plant agrees with that of *D. Ebenaster*. Ramirez, in his "Sinonimia de las Plantas Mexicanas," p. 94, gives the vernacular name as "Tlilzápotl" and the locality as Morelos. Hernandez (who explored Mexico between 1571 and 1577) on two separate occasions in his "Opera" (p. 129 and p. 164 of vol. i.), speaks of the medicinal properties of the tree, but the figure of "Tlilzápotl" in Recchus' edition of Hernandez, p. 430, does not agree with *D. Ebenaster* in that the fruits are somewhat pointed at the apex. Hemsley ("Biologia Cent. Americana," vol. ii. p. 300), states that the tree is only found in cultivated places, and is of the opinion that it has been introduced.

From Brazil, *Glaziou* 7747 is cultivated, and it may be noted that Martius in the "Flora Brasiliensis" is very vague as to the exact locality of *D. brasiliensis* (= *D. Ebenaster* according to Hiern), only stating that it grows in the interior! Part at least, if not all, of the material from Dominica is from the Botanic Gardens, so that the tree may be introduced there; but the fact that it is popularly called "bambarra" by the natives in the island suggests that it may be indigenous and more common than our specimens indicate.

From the evidence we have collected, therefore, we must conclude that the natural habitat of *Diospyros Ebenaster*, Retz., is in the West Indies. With regard to Mexico, it is evident from the references quoted above that the tree must have existed there for at least three centuries. As the native name "Tlilzápotl" is merely the Indian rendering of the Spanish "Zapote negro," it is very probable that the tree was introduced into Mexico by the Spaniards, but if this be correct, the introduction must have taken place at a very early date.

It may be fitting to conclude these remarks with a note on the narcotic or poisonous properties of the fruit of this interesting tree. The fruit is large, reaching three inches in diameter; it is globose in shape and of an olive- or yellowish-green colour, while the pulp is dark. The fruit (including the seeds) is pounded and thrown into the rivers by the natives of the West Indies in order to stupefy the fish and so facilitate their capture. Some observers—Greshoff being the most recent of them—declare that the fish are killed by partaking of this fruit.

V.—THE SOUTH AFRICAN SECTIONS OF LORANTHUS.

T. A. SPRAGUE.

The genus *Loranthus** has been divided into a large number of groups, which have been treated by Van Tieghem as independent genera, by Engler as subgenera, sections and series.†

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* As defined in Engler & Prantl, Nat. Pflanzenfam, vol. iii., 1, p. 183.
† See Kew Bull. 1914, pp. 362–367.

In 1910, the 215 species of *Loranthus* then known from Tropical Africa were classified by the writer in 29 sections.* The South African species have been arranged in a similar way in the forthcoming part of Dyer, Flora Capensis, vol. v. sect. 2, but owing to the relatively small number of species concerned, it seemed inadvisable to introduce the names of the sections into the key. In order to facilitate comparison with the classification adopted in The Flora of Tropical Africa, a key and enumeration of the South African sections are now given.

KEY TO THE SECTIONS.

Corolla polypetalous.
  Flowers tetramerous; petals under $\frac{3}{4}$ in. long; claws without ridges.
    Anthers transversely septate ... ... I. SYCOPHILA.
    Anthers not transversely septate ... II. ACROSTACHYS.
  Flowers pentamerous; petals $1\frac{1}{2}$–$2\frac{1}{4}$ in. long; claws with several pairs of oblique ridges, which descend from the adnate portion of the filament ... ... III. PLICOPETALUS.

Corolla gamopetalous.
  Filaments not produced into a tooth in front of the anther.
    Anthers transversely septate ... ... IV. SEPTULINA.
    Anthers not transversely septate.
      Corolla-tube not splitting unilaterally.
        Corolla-lobes revolute ... ... V. MOQUINIA.
        Corolla-lobes reflexed.
          Corolla glabrous.
            Filaments straight, not thickened above ... ... VI. TETRAMERI.
            Filaments much thickened and involute above ... ... VII. INCRASSATI.
          Corolla villous with subappressed hairs ... ...VIII. HIRSUTI.
      Corolla-lobes erect, cohering unilaterally in a single piece ... IX. QUINQUENERVES.
      Corolla-tube splitting unilaterally.
        Umbels terminating leafy short-shoots, which are perulate at the base ... ... X. ACRANTHEMUM.
        Umbels axillary ... ... XI. INFUNDIBULIFORMES.
  Filaments produced into a tooth in front of the anther.
    Flowers pentamerous; style skittle-shaped above.
      Corolla-lobes reflexed ... ... XII. TAPINANTHUS.
      Corolla-lobes erect ... ...XIII. ERECTILOBI.
    Flowers tetramerous; style not skittle-shaped ... ...XIV. ISCHNANTHUS.

* Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 256-273.

Sect. I. Sycophila, *Engl.* in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. i. p. 128; Sprague in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, p. 257. Genus *Sycophila*, Welw. ex Van Tiegh. in Bull. Soc. Bot. France, vol. xli. p. 485 (1894). Sect. *Heteranthus*, Benth. & Hook. f. Gen. Pl. vol. iii. p. 208, partim; Engl. in Nat. Pflanzenfam. vol. iii. p. 185, partim.

S. African species: *L. Woodii*, Schlechter & Krause, *L. subcylindricus*, Sprague.

Sect. II. Acrostachys, *Benth.* in Benth. & Hook. f. Gen. Pl. vol. iii. p. 208 (1880); Engl. in Engl. & Prantl, Nat. Pflanzenfam. vol. iii., 1, p. 188; Nachtr. i., p. 133; Sprague in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 256, 258. Genus *Acrostachys*, Van Tiegh. in Bull. Soc. Bot. France, vol. xli. p. 504.

S. African species: *L. garcianus*, Engl.

Sect. III. Plicopetalus, *Benth.* in Benth. & Hook. f. Gen. Pl. vol. iii. p. 208 (1880); Engl. in Engl. & Prantl, Nat. Pflanzenfam. vol. iii., 1, p. 188; Engl. Jahrb. vol. xx. p. 130; Sprague in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 256, 258. Sect. *Euplicotepalus*, Engl. in Nat. Pflanzenfam. Nachtr. i. p. 133. Genus *Plicosepalus*, Van Tiegh. in Bull. Soc. Bot. France, vol. xli. p. 504.

S. African species: *L. undulatus*, E. Meyer, *L. kalachariensis*, Schinz.

Sect. IV. Septulina, *Sprague* in Kew Bull. 1914, p. 367. Genus *Septulina*, Van Tiegh. in Bull. Soc. Bot. France, vol. xlii. p. 263 (1895). Series *Cinerascentes*, Engl. in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. i. p. 131, partim. Series *Longitubulosi*, Engl. & Krause in Engl. Jahrb. vol. li. p. 455 (1914).

Endemic in S. Africa. Differs from sect. *Cinerascentes* in the tetramerous flowers, reflexed* corolla-lobes, and erect filaments.—*L. glaucus*, Thunb., *L. ovalis*, E. Meyer.

Sect. V. Moquinia, *Sprague* in Kew Bull. 1914, p. 367. Genus *Moquinia*, A. Spreng. Tent. Suppl. Syst. Veg. p. 9 (1828). Series *Oleaefolii*, Engl. in Engl. Jahrb. vol. xx. p. 83. Series *Lichtensteinia*, Engl. in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. i. p. 131. Genus *Lichtensteinia*, Van Tiegh. in Bull. Soc. Bot. France, vol. xlii. p. 254, non Wendl.

Endemic in S. Africa. Allied to sect. *Tetrameri*, from which it differs in the revolute corolla-lobes.—*L. elegans*, Cham. & Schlecht.

Sect. VI. Tetrameri, *Sprague* in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 256, 264 (1910). Series *Tetrameri*, K. Krause in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. iv. p. 72. Series *Longiflori*, Engl. in Engl. Jahrb. vol. xx. pp. 82, 92, partim; Engl. & Prantl, Nat. Pflanzenfam. Nachtr. i. p. 131, partim.

S. African species: *L. Galpinii*, Schinz.

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* By a typographical error the corolla-lobes were stated to be erect in Kew Bull. 1914, p. 367.

Sect. VII. Incrassati, *Sprague* in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 256, 263 (1910). Series *Incrassati*, K. Krause in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. iv. p. 72.
S. African species: *L. Wyliei*, Sprague.

Sect. VIII. Hirsuti, *Sprague* in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 256, 263. Series *Hirsuti*, Engl. in Engl. Jahrb. vol. xx. p. 104 (1894); Engl. & Prantl, Nat. Pflanzenfam. Nachtr. i. p. 132. Genus *Erianthemum*, Van Tiegh. in Bull. Soc. Bot. France, vol. xlii. p. 247.
S. African species: *L. Dregei*, Eckl. & Zeyh.

Sect. IX. Quinquenerves, *Sprague*. Leaves alternate. Umbels axillary; bract cupular. Flowers pentamerous. Receptacle and calyx together cylindric, longer than the bract. Corolla-tube not splitting unilaterally, with a distinct basal swelling; limb splitting unilaterally, the lobes remaining connate above in a single erect piece. Stamens inserted a considerable distance above the base of the corolla-lobes; filaments filiform, inflexed or involute, with two minute teeth below their apex on the ventral surface; anthers linear, not transversely divided. Style filiform; stigma subglobose.
Endemic in S. Africa. Allied to Sect. *Incrassati*, from which it differs in the corolla and filaments. Type and sole species: *L. quinquenervis*, Hochst.

Sect. X. Acranthemum, *Sprague*. Genus *Acranthemum*, Van Tiegh. in Bull. Soc. Bot. France, vol. xlii. p. 254 (1895). Series *Acranthemum*, Engl. in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. i. p. 131.
Endemic in S. Africa. Allied to Sect. *Longiflori*, from which it differs in the umbels terminating leafy short-shoots, which are perulate at the base, and the filaments inserted near the base of the corolla-lobes. The style is skittle-shaped above in 3 out of the 4 species.—*L. Zeyheri*, Harv., *L. Moorei*, Sprague, *L. natalitius*, Meisn., *L. minor*, Sprague.

Sect. XI. Infundibuliformes, *Sprague* in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 257, 264. Series *Infundibuliformes*, Engl. in Engl. Jahrb. vol. xx. pp 82, 89 (1894); Engl & Prantl, Nat. Pflanzenfam. Nachtr. i. p. 132 Series *Inflati*, Engl., l.c. 82, 91; l.c. 132. Series *Glomerati*, Engl., l.c. 82, 88. Genus *Agelanthus*, Van Tiegh. in Bull. Soc. Bot. France, vol. xlii. p. 246.
S. African species: *L. Bolusii*, Sprague.

Sect. XII. Tapinanthus, Blume, Fl. Jav. Loranth. p. 15; Endl. Gen. Pl. vol. ii. p. 802, excl. *Moquinia*; Benth. in Benth. & Hook. f. Gen. Pl. vol. iii. p. 210, excl. *L. dodonaeifolius* et *L. Schimperi*; Engl. in Engl. & Prantl, Nat. Pflanzenfam. vol. iii. 1, p. 187, partim; Sprague in Kew Bull. 1914, p. 367. Genus *Tapinanthus*, Blume apud Schult. Syst. Veg. vol. vii. p. 1730 (1830); Van Tiegh. in Bull. Soc. Bot. France, vol. xlii. p. 267, partim. Genus *Lichtensteinia*, Wendl. Coll. Pl. vol. ii. p. 4, t. 39 (1810); Blume apud Schult. Syst. Veg. vol. vii.

p. 1730. Sect. *Lichtensteinia*, Blume, Fl. Jav. Loranth. p. 14. Series *Constrictiflori*, Engl. in Engl. Jahrb. vol. xx. pp. 108, 113, partim; Engl. & Prantl, Nat. Pflanzenfam. Nachtr. i. p. 133, partim. Sect. *Constrictiflori*, Sprague in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 257, 268.

S. African species: *L. rubromarginatus*, Engl., *L. oleaefolius*, Cham. & Schlecht. (*L. namaquensis*, Harv.).

Sect. XIII. Erectilobi, *Sprague* in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 257, 270 (1910). Series *Erectilobi*, K. Krause in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. iv. p. 73. Series *Constrictiflori*, Engl. in Engl. Jahrb. vol. xx. pp. 108, 113, partim. Genus *Tapinanthus*, Van Tiegh. in Bull. Soc. Bot. France, vol. xlii. p. 267, partim.

S. African species: *L. Kraussianus*, Meisn., *L. prunifolius*, E. Meyer.

Sect. XIV. Ischnanthus, *Engl.* in Engl. Jahrb. vol. xx. p. 125 (1894); Engl. & Prantl, Nat. Pflanzenfam. Nachtr. i. p. 132; Sprague in Dyer, Fl. Trop. Afr. vol. vi. sect. 1, pp. 257, 272. Genus *Ischnanthus*, Van Tiegh. in Bull. Soc. Bot. France, vol. xlii. p. 260. Genus *Stephaniscus*, Van Tiegh, l.c.

S. African species: *L. Schlechteri*, Eng.

The distribution of the South African sections of *Loranthus* exhibits certain features of interest. Three of the four endemic sections, *Moquinia*, *Quinquenerves* and *Acranthemum* are related respectively to the East African sections *Tetrameri*, *Incrassati* and *Longiflori*, whilst the fourth, *Septulina*,, is allied to the West African *Cinerascentes*. Of the non-endemic groups, six* occur both in East and West Tropical Africa, three† in East Africa only, and one‡ in West Tropical Africa. Thus the relationship of both the endemic and non-endemic groups with those of East Tropical Africa is three times as great as with those of West Tropical Africa.

The section *Sycophila* affords a good example of discontinuous distribution, nine species occurring in West Tropical Africa (Cameroons to Angola), and two in Natal and Zululand. *Sycophila* is regarded by the writer as one of the most primitive of the African sections, on account of the flowers being arranged in racemes,§ the polypetalous corolla, and the straight erect filaments. Its discontinuous distribution is in keeping with this hypothesis.

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* *Acrostachys*, *Plicopetalus*, *Infundibuliformes*, *Constrictiflori*, *Erectilobi*, *Ischnanthus*.

† *Hirsuti*, *Incrassati*, *Tetrameri*. The section *Hirsuti* includes 10 species, 9 of which are confined to East Africa, whilst the tenth, *L. Dregei*, is widely distributed in East Africa, from Eritrea to the Komgha Division of Cape Colony, and extends into Angola. For the purposes of the present comparison this extension is best neglected.

‡ *Sycophila*.

§ In most of the sections the flowers are in umbels, fascicles or capitula. *Moquinia* exhibits transitional forms between a raceme and an umbel.

VI.—THE SELECTION OF COCOANUTS FOR GERMINATION.

In connection with the propagation of cocoanuts it is a widely held belief that the nuts from young trees should not be used and that plants should only be raised from fully-matured trees.

This belief appears to be based on the following passage from Simmonds' "Tropical Agriculture"* :—"The nuts for sprouting should be chosen from those fully ripe, having full, large eyes, and such as have been gathered from trees past the middle age—not, however, from aged ones—and from clusters containing few fruits. These, if carefully planted, are said to ensure the timely sprouting and steady growth of the plant as well as future luxuriance, longevity, and unintermitting fruitfulness. . . . Those nuts which may be taken from trees of immature age will, if planted, rot away at the eye; and the plants, if any be successfully reared, on transplanting will grow very rapidly and acquire bulk, but the fruit will drop before the kernel acquires consistency, the root stalks break, and the trees entirely fail before mid-age."

Efforts have been made to discover what truth there may be in the above statement, but neither direct confirmation nor absolute refutation has been obtained. On physiological grounds there would appear to be no justification for the statement as it stands, though no doubt it would be unwise for more than one reason to plant nuts from young trees in the first year or two of their coming into bearing.

We have failed to find any earlier reference in economic literature to the statement made by Simmonds, and it is not impossible that he may have based it on a superstitious native belief which had come to his notice. But all attempts to trace its origin have so far been unsuccessful. It is, too, not inconceivable that the statement may merely embody the argument of the owner of a plantation containing trees of a particular age, which was being offered for sale.

The following passage taken from a recent book on the Cocoanut, by E. B. Copeland,† deals with the vexed question of the seed nuts, and contains useful practical suggestions :—

"B. *Selection of the seed.*—Whatever variety of coco-nut may be chosen, the seeds which are to be planted should be selected as the product of individual trees, and these trees should be very carefully picked out and should be the ones which most exactly have the qualities which it is desirable to give to the entire plantation. There is no point in the coco-nut business where careful personal attention is more necessary or will prove more profitable than in the selection of the trees which are to furnish the seed nuts. Leaving out of account selection for any of the minor uses, and considering only the production of copra or oil, there is one safe and sufficient rule. Select the seed of the Trees

* Simmonds, P. L. Tropical Agriculture, pp. 220. 221. London, 1877.

† The Coco-nut. E. B. Copeland. London, Macmillan & Co., Ltd. pp. 116-118.

which are conspicuously more productive than are their neighbours which are growing under the same conditions.

"If a tree is especially productive because it grows in especially rich soil, or because it is well watered or well fertilized, or because it is freely illuminated on all sides, then, no matter how conspicuously productive it may be, there is no sound reason for choosing it as the source of seed. Seeds are chosen for their hereditary qualities, and a good environment cannot be inherited. A tree in the middle of a grove which regularly produces more nuts or larger nuts than its neighbours, and is without any compensating drawback, should be selected as the source of seed, even though a tree at the outside of the same grove which is still more productive be passed over.

"The selection of nuts from piles or at any time after they are cut from the tree is not to be recommended. A tree bearing very few nuts is for that reason likely to bear large ones, and it will thus often happen that the selection of large nuts from the nut pile is in effect selection from trees which are not very productive. Moreover, there is a chance that the large nuts in general nut piles are from trees which produce large nuts because they grow under especially favourable conditions, and, as we have just seen, there is no reason whatever why the fruit of such trees, however good it may be, should be selected for propagation.

"When the trees which are to be the source of seed nuts have been selected, their nuts should be regarded as having a value which is based on the value of the trees they will produce, and as therefore out of all proportion to the value which they have as mere nuts. It is worth while to harvest these nuts with a care which would be economically impossible for nuts intended for the production of copra. It is well worth while to collect the nuts of a good seed tree by lowering them to the ground by hand in order that there can be no risk of breaking or cracking them. A cracked nut will never germinate.

"The nuts are ready to be used for seed at the same time at which they are really ready to be used for copra, that is, when a third or a half of the water in the interior cavity has been used up. This condition can be recognized by the heaviness of the nut and by the noise which it makes when shaken."

The following paragraph taken from the "Directions for Planting Coco-nut Trees," issued by the Board of Agriculture, British Guiana, contains information very similar to that given by Copeland:—

"*Selection of Seeds.*—Nuts which are quite ripe should be chosen from trees which bear good crops of nuts having thin husks and thick kernels (copra), and which are neither very young nor very old. They should either be picked and not allowed to fall, as by so doing they may be injured, or, if not picked, fallen ripe nuts should be selected with uninjured husks; they should be kept a month before sowing. The larger ones on the bunches should be selected for planting, but very big nuts are not always the best, because only a few may be borne on the tree, while frequently their size is due to excessive development of husk at the expense of the kernel; oblong nuts should be avoided. The

large orange-red variety is the best for planting, in view both of size of coconut and of yield of copra."

One of the chief reasons, no doubt, for the recommendation that nuts should be taken from trees of some maturity is that the character of the nuts yielded by such trees would be well known, and it is probable that the nuts borne by quite young trees would not show their true character.

The following extract relating to seedling cocoanuts in the Laccadives* is also of interest in connection with this subject:—

"In most of the islands it is deemed necessary to raise the seedling coco-nuts with care and attention till they are a year old, when they are transplanted and watered for a few weeks till they become firmly established. After this the young trees are left entirely to themselves, and are neither watered nor manured; they come into bearing in Kiltan in from 8 to 10 years, and produce fruit so vigorously and plentifully that it is sometimes necessary to support the luxuriant growth of nuts artificially; in this island, moreover, the preliminary attention to seedlings is not required.

"In some of the other islands, as in Chitlac, where the soil is much poorer, the trees do not come into bearing till they are 15 to 20 years old, each tree at best producing only about 50 nuts per annum as against 80 to 85 nuts a year in Kiltan. In Kadamum, too, backward though the cultivation in that island is, the average per annum is about 80 nuts per tree; in Ameni, where the cultivation is almost as extensive as in Kiltan, the average is only about 60 nuts a year from each tree. These figures are given by Robinson, after careful and prolonged enquiry, as representing the yield in 1844 and 1845; Hume gives the average all over for the four British islands in 1875 at 80 nuts per tree per annum—doubtless rather a high general estimate, though probably representing the yield of what the people in any of the islands would themselves consider a good tree. Robinson thinks that 60 to 70 nuts would be a pretty fair general average for the whole of these islands, and this is likely to be nearer the truth than the higher estimate. The islanders try to plant only first-class trees, and they aim at obtaining such as will come into full bearing in about 10 years, throwing out every month after that age is reached a fruiting-spike bearing 15 to 20 nuts, and so yielding 180 to 250 nuts a year, and going on bearing at this rate till they are 60 years old. They often do go on bearing, it is said, till they are 70 or 80 years of age, and some are believed by the people to be more than a century old."

Young cocoanut trees vary considerably in the age at which they commence to yield, and in some cases as many as ten years may elapse before any nuts are borne. In pronouncing an opinion as to the proper age or size of trees from which seed nuts should be selected, it would be better therefore not to take nuts for this purpose until the trees are at least in their third or fourth year of bearing. Judging from particulars received of cocoanut plantations in the Island of Nevis, West Indies, it would appear that

* "Botany of the Laccadives," D. Prain in Journ. Bombay Nat. Hist. Soc. 1892, sec. 2, No. 5, pp. 65, 66.

cocoanut palms in their third year of bearing yield perfectly sound and full-sized nuts, which, when used for seed, can be relied upon to germinate freely and in a normal manner.

The plantations in Nevis were started by Mr. Crum-Ewing in the autumn of 1907 on old sugar-cane land, which is almost at sea-level. The soil is a nice loam, gradually getting lighter until it becomes pure sand on the sea-shore.

The average rainfall for the years 1909–13 inclusive was 43·87 inches, but the deficiency is compensated for by the plentiful underground supply of water draining from the high cone-shaped mountain which forms the centre of the small circular Island of Nevis.

The seed was obtained from Jamaica by Mr. Barclay, Secretary of the Jamaica Agricultural Society, who took some trouble to obtain nuts from the most healthy plantation in that Island. The seed for that plantation in turn came from San Blas, whence come the finest nuts in the Western Hemisphere.

The number of nuts planted up to the end of 1911 amounted to 10,305. The trees are planted 28 feet apart, or 52 to the acre. Certain trees commenced to bear in 1911, and Mr. Crum-Ewing saw one early in 1912, 4 years 4 months old, bearing 40 nuts. Reaping in any quantity, however, did not commence till 1913, when the 1907 plants would be about 5 years 3 months old.

From January 11, 1913, to June 30, 1914, the number of nuts harvested amounted to 23,807. From January 11 to October 23, 1913, a 4 in. gauge was used, which resulted in 77·4 per cent. of selects and 22·6 per cent. of culls. Both selects and culls were sent to New York, where the market took both grades as select, paying $42·50 per 1000, about the highest price which has been paid for any cocoanuts in that city. Since October 23 a $3\frac{7}{8}$ in. gauge has been used (which is $\frac{1}{8}$ in. larger than the Malay regulation gauge of $3\frac{3}{4}$ in.), and of the 75,116 nuts gathered, 68,419 or 91·08 per cent. have been select, and 6697 or 8·92 per cent. have been culls. A selection is made in the field of the nuts while in the husk, and it is found that 95 per cent. to 98 per cent. of these nuts when husked are over the $3\frac{7}{8}$ gauge.

In choosing nuts for seed, greater care is bestowed on selection, than when husking and selling raw nuts is contemplated, so that the percentage of standard nuts would be increased. A certain number of trees are known not to give such a good percentage of selects, although the unhusked nuts from them look good. When selecting nuts for seed none are taken from these trees, which still further reduces the percentage of culls. The rots will not of course germinate, so that of the sprouts taken from the nursery, it may safely be assumed that nearly 100 per cent. are from nuts over the $3\frac{7}{8}$ in. standard.

Out of 1000 seed nuts sent to Demerara in July, 1913, it was reported on February 28, 1914, that 89 per cent. of these had germinated, that the others seemed quite good, and that more were expected to grow. In March, 1913, 50 nuts were planted standing up and 50 on their sides by way of experiment in Nevis. On October 24, 1913, it was reported that out of the 50 on their sides 46, or 92 per cent., had germinated, and of those standing up only 30 or 60 per cent. had germinated.

The high percentage of good-sized nuts on the young plantations at Nevis is of both general and commercial interest and affords ample justification for the great trouble which was taken in selecting the original seed nuts in Jamaica and elsewhere. As to the selection of the seed Mr. Crum-Ewing writes:—"I do not understand Simmonds' advice to take seed nuts from clusters containing few fruits—on a prolific tree there should be no such clusters. I quite agree with you that seed nuts should be taken from trees whose good character is well marked. It appears to me that the pedigree of a cocoanut tree is of the utmost importance. Even if I had only one or two years' experience of a tree, and it showed the same characteristics, for which its parent, and yet again its grand-parent had been selected, I would rather use the seed from that tree than take Simmonds' advice to choose one picked from a sparsely furnished cluster grown on a tree past the middle age, of whose parentage there is no record."

The nuts which are now being planted on Mr. Crum-Ewing's land in Nevis and in Demerara are taken from the young trees planted in Nevis in 1907. As already mentioned, the germination percentage of the nuts sent from Nevis to Demerara in July, 1913, was 89 per cent., which certainly refutes the statement made by Simmonds that nuts from young trees "rot away at the eye." Mr. Crum-Ewing informs us that he is planting nothing but his own Nevis seed both in the Island and in Demerara, and adds:—"I feel justified in so doing, knowing the great care with which the seed is selected, the minute observation to which the individual trees have been subjected, the absence of disease in the grove and in the Island, and the good stock from which the parents and grand-parents were derived."

These experimental plantings should, in the course of a few years, enable a proper estimation to be made of Simmonds' statements, but in the light of the practical experience already gained, it seems highly unlikely that his recommendations will receive support.

VII.—DIAGNOSES AFRICANAE: LXIII.

1541. **Heliotropium undulatifolium,** *Turrill* [Boraginaceae-Heliotropieae]; *H. longifloro,* Hochst. et Steud., affine, sed foliis minoribus angustioribusque undulatis, inflorescentiis brevioribus, corollis majoribus differt.

Fruticulus e basi lignosa praecipue ramosissimus, ramis adpresse hirsutis. *Folia* linearia vel oblongo-linearia, undulata, apice obtusa vel subobtusa, basi gradatim angustata, usque ad 2·5 cm. longa et 4 mm. lata, saepissime angustiora, pagina superiore dense adpresse hispida costa impressa nervis lateralibus inconspicuis, inferiore costa et nervis lateralibus prominentibus dense adpresse hispidis. *Inflorescentia* terminalis, e cymis 3–5 sub anthesi circiter 2·5 cm. (infructescentibus usque ad 6·5 cm.) longis composita, dense hispida, floribus sessilibus. *Calycis* segmenta 5, linearia, subacuta, 1·5 cm. longa, extra dense hispida; tubus 0·5 mm. longus. *Corollae* tubus cylindricus, medio leviter

ampliatus, 5 mm. longus, medio 1·25 mm. basi apiceque 1 mm. diametro, extra adpresse hispidus, intus glaber; limbus albus, circiter 7 mm. diametro, lobis 5 triangularibus apice acuminatis vel leviter caudatis basi 1·5 mm. latis. *Stamina* 2 mm. supra corollae tubi basem inserta, sessilia, 1 mm. longa. *Ovarium* fere sphaericum, circiter 0·5 mm. diametro, glabrum; stylus stigmate incluso 3 mm. longus; stigma anguste pyramidale, apice leviter bifidum, basi tumescens, 1·5 mm. longum. *Nuculae* 4, bilateraliter compressae, 3 mm. altae, diametro longiore 2 mm., breviore 1·5 mm., verrucis in lineas longitudinales dispositis instructae.

Tropical Africa. British East Africa: Lake Naivasha, 1800 m., *G. F. Scott Elliott* 6515. Kikuyu and on road to Eldama Ravine, 1200–1800 m., *A. Whyte*. Open plains beyond Guaso Nyoro, 1800 m., *M. S. Evans* 753, 767. West Kenya plains 1890–2040 m., *E. Battiscombe* 720. "Perennial herb, 5–12 inches, corolla white".

1542. **Solanum keniense,** *Turrill* [Solanaceae–Solaneae]; *S. scalari*, C. H. Wright, affine, sed ramis junioribus petiolisque pilis stellatis patentibus tectis, foliis pagina superiore pilis longis adpressis facie simplicibus sed sub oculo armato ima basi brevissime stellatim ramosis instructis, floribus majoribus, praecipue distinguendum.

Herba scandens (ex *Battiscombe*) ramis teretibus primo pilis stellatis patentibus tectis mox glabris. *Folia* oblongo- vel rhomboideo-ovata, apice acuta vel subacuminata, basi obtusa, interdum plus minusve inaequaliteralia, usque ad 12·5 cm. longa et 8 cm. lata, margine repando, pagina superiore costa et nervis lateralibus utrinque 4–5 leviter impressis, inferiore prominentibus, infra pilis stellatis parvis, supra pilis longis facie simplicibus sed sub oculo armato ima basi brevissime stellatim ramosis tectis; petioli usque ad 4 cm. longi, pilis stellatis patentibus instructi. *Inflorescentia* extra-axillaris, e floribus 6–8 (quorum usque ad 6 fertilibus) composita, pilis stellatis patentibus instructa, pedunculo 1–1·5 cm. longo suffulta; pedicelli usque ad 1·2 cm. longi. *Calycis* segmenta acuminata, 4 mm. longa, 1·5 mm. lata, extra dense stellato-tomentosa, intus glabra. *Corolla* quinquelobata, 1·7 mm. diametro, lobis 7 mm. longis 5 mm. latis extra minute stellato-tomentosis intus glabris. *Stamina* 5, filamentis 0·5 mm. longis, antheris 5 mm. longis apice biporosis. *Ovarium* ovoideum vel obovoideum, 1–1·5 mm. altum, 0·75–1 mm. diametro, glabrum vel apice leviter stellato-pubescens; stylus 8 mm. longus, inferne dense stellato-pubescens; stigma leviter bilobatum. *Bacca* sphaerica, 8 mm. diametro, rubra.

Tropical Africa. British East Africa; Eastern Kenya forests, 1350 m., *E. Battiscombe* 853. "Corolla mauve, ripe fruit red."

1543. **Arthrosolen variabilis,** *C. H. Wright* [Thymelaeaceae–Euthymelaeeae]; *A. gymnostachyi*, C. A. Meyer, affinis, inflorescentia bracteata, foliisque angustioribus differt.

Caulis erectus, teres, lignosus, glaber; rami plures, virgati, primum pilis longis appressis vestiti. *Folia* alterna, rarius subopposita, sessilia, oblonga vel oblongo-lanceolata, acuta, subtus

sericea, supra glabra vel sparse pilosa, 1·2 cm. longa, 2–3 mm. lata. *Spica* terminalis, elongatus; bracteae calyce breviores. *Calyx* 6–8 mm. longus, carnosus, carneus vel lutescens, basi ovoideus; tubus cylindricus, extus appresse tomentosus; lobi 4, obtusi, 1·5 mm. longi, exteriores ovati, 1 mm. lati, interiores oblongi, 0·75 mm. lati. *Stamina* 8. *Ovarium* ovatum, compressum, coma pilorum alborum rectorum 0·75 mm. longorum terminatum; stylus excentricus. *Fructus* ovoideus, acuminatus, 3 mm. longus.

South Africa. Kalahari Region: Orange River Colony, Besters Vlei near Witzies Hoek, *Bolus* 8243. Transvaal; near Ermelo, *Burtt-Davy* 960, Lydenburg, *Wilms* 1287, 1288. Eastern Region: Griqualand East; by streams near Kokstadt, *Tyson* 1214. Natal; Weenen County, *Wood* 4550, grassy hill near Newcastle, *Wood* 7200, near Charlestown, *Wood* 4802, and without precise locality, *Gerrard* 284.

This species, which grows at altitudes between 1299 and 1834 metres, varies in the length and colour of its calyx and also in the length and amount of the indumentum upon it. No satisfactory line can be drawn between the forms included here, which merit further study in the field. *A. fraternus*, N.E. Br., differs in having opposite leaves and in the absence of bracts.

1544. **Loranthus (Sycophila) subcylindricus,** *Sprague* in Dyer, Fl. Cap. vol. v. sect. 2, p. 103, anglice [Loranthaceae]; affinis *L. Woodii*, Schlechter et Krause, a quo toro subcylindrico discoque distincto recedit.

Folia lanceolata vel oblanceolata, 2·5–7 cm. longa, 0·8–2 cm. lata, margine crispatulo; petiolus 2–6 mm. longus, alatus. *Racemus* rhachi usque ad 2·5 cm. longa; pedicelli 2–4 mm. longi, apice haud vel paullulum obliqui; bractea erecta, ovata, perconcava, 1 mm. longa, dimidio inferiore umbonato. *Torus* subcylindricus, 2 mm. longus vel ultra. *Petala* 0·9–1·2 cm. longa; unguis 2–2·5 mm. longus, 1–1·5 mm. latus, vitta ventrali longitudinali incrassata. *Filamenta* 3·5 mm. longa; antherae 3–4·5 mm. longae, locellis 18–26. *Discus* quadrangularis, styli basin amplectens, eae adnatus vel liber. *Stylus* 7·5–8 mm. longus. *Bacca* oblongo-ellipsoidea.—*L. Woodii*, Schlechter et Krause, in Engl. Jahrb. vol. li. p. 454, partim.

South Africa. Natal: Alexandra District; by the Umtwalumi River, on *Ochna arborea*, Burch., *Rudatis* 904. Zululand: Nkandhla, 1200–1500 m., *Wylie in Herb. Wood* 9013.

1545. **Loranthus (Incrassati) Wyliei,** *Sprague* in Dyer, Fl. Cap. vol. v. sect. 2, p. 110, anglice [Loranthaceae]; affinis *L. Menyharthii*, Engl. et Schinz, a quo foliis minoribus glabris differt; facie *L. quinquenervi*, Hochst., similis, corollae lobis reflexis filamentisque distinguitur.

Rami subteretes, nodosi, cinerei, graciliusculi, circiter 2 mm. diametro 15 cm. infra apicem, glabri; ramuli pilis brevissimis simplicibus minute densiuscule induti; internodia 0·6–1·2 cm. longa. *Folia* alterna, petiolata, oblanceolata vel oblongo-oblanceolata, 1·7–2·7 cm. longa, 0·6–1·1 cm. lata, apice obtusa vel rotundata, in

basin angustata, tenuiter coriacea, glabra, penninervia, nervis utrinque leviter elevatis, iis jugi infimi valde obliquis costae subparallelis; petiolus 1–2 mm. longus, supra minute pilosus. *Fasciculi* axillares, 2–3-flori, vel flores solitarii; pedicelli 1–1·3 mm. longi; bractea cupularis, subtruncata lobo dorsali late ovato, extra minute pilosa, grosse ciliata, infra lobum leviter umbonata, margine dorsali 2·3 mm. longo, margine ventrali 1·5 mm. longo. *Flores* pentameri. *Torus* calycecum anguste cylindricus, 6 mm. longus, 1·3 mm. diametro; torus calyce paullulo latior, glaber. *Calyx* 4 mm. longus, quinquedentatus, ciliatus, ceterum glaber, dentibus triangularibus 0·35 mm. longis. *Corolla* circiter 5 cm. longa, glabra, in alabastro linearis, superne clavata, acuta, parte apicali incrassata circiter 7 mm. longa; tubus ampulla suprabasali inconspicua, supra ampullam per 3 mm. angustissimus, deinde ad apicem sensim expansus; lobi circiter 3 cm. longi, medio reflexi, parte inferiore a basi lata lineari; parte superiore oblanceolato-lineari. *Filamenta* 9 mm. supra basin corollae loborum inserta, parte inferiore erecta filiformi, 8 mm. longa, parte superiore valde incrassata, sub anthesi spiraliter involuta; antherae lineares, fere 4 mm. longae, haud transverse septatae, connectivo truncato. *Discus* acute lobatus. *Stylus* filiformis, stigmate ovoideo 1·3 mm. longo.

South Africa. Zululand: Ngoya, *Wylie in Herb. Wood* 7468.

1546. **Loranthus (Tetrameri) Galpinii,** *Schinz ex Sprague* in Dyer, Fl. Cap. vol. v. sect. 2, p. 112, anglice [Loranthaceae]; affinis *L. panganensi,* Engl., a quo floribus pentameris distinguitur.

Planta glabra. *Rami* crassiusculi, valde nodosi, griseobrunnei, densiuscule lenticellati, post lapsum foliorum inflorescentias gerentes, 4–5 mm. diametro; ramuli laeves, brunnei, circiter 3 mm. diametro 15 cm. infra apicem; internodia 0·8–3 cm. longa. *Folia* opposita, petiolata, oblongo-lanceolata, recta vel leviter curvata, 7·5–11 cm. longa, 1–2 cm. lata, apice obtusa vel apiculata, in basin sensim angustata, rigide coriacea, penninervia, nervis lateralibus obliquis, utrinque plus minusve elevatis vel indistinctis, costa manifeste elevata; petiolus 8–10 mm. longus. *Umbellae* axillares, 2-florae, singulae in ramulis, singulae vel geminatae in parte defoliata ramorum; pedunculus crassus, 3–6 mm. longus, parte receptaculari marginata, margine tenui 0·7 mm. lato; pedicelli circiter 2 mm. longi, crassissimi; bractea subcupularis, bilabiatus, labio dorsali ereeto 2·5–3 mm. longo rotundato, labio ventrali patulo 0·8 mm. longo truncato. *Flores* pentameri. *Torus* calycecum campanulatus, supra medium valde expansus, 6 mm. longus; torus 3·5 mm. longus, 2·5 mm. diametro. *Calyx* cupularis, truncatus, 2·5–3 mm. longus, 4·5 mm. diametro. *Corolla* lutea, circiter 7·5 cm. longa, in alabastro linearis, superne paullulum clavata; tubus pentagonus, basi haud inflatus, infra medium sensim ad apicem expansus, haud unilateraliter fissus; lobi 4·5 cm. longi, 2·5 mm. lati, lineari-oblanceolati, acuti, 5–6 mm. supra basin reflexi. *Stamina* kermesina; filamenta 3 mm. supra basin corollae loborum inserta, erecta, circiter 2 cm. longa,

vix 1 mm. lata; antherae lineares, sursum leviter ampliatae, 4·6 cm. longae, connectivo truncato. *Discus* in toro depressus, pentagonus, 0·8 mm. altus. *Stigma* late ovoideum, 1·5 mm. longum.

South Africa. Transvaal: Kaap River valley, Barberton, on *Sclerocarya caffra*, Sond., *Galpin* 896.

1547. **Loranthus** (**Acranthemum**) **Moorei,** *Sprague* in Dyer Fl. Cap. vol. v. sect. 2, p. 114, anglice [Loranthaceae]; affinis *L. Zeyheri*, Harv., et *L. natalitio*, Meisn., ab hoc foliis glaucis, bractea torum et calycem superante vel aequante, ab illo glabritie facile distinguitur.

Rami, ramuli abbreviati, folia, inflorescentiae glabri. *Folia* glauca. *Umbellae* circiter 6-florae; bractea a basi patelliformi unilateraliter producta, vel foliacea, 0·6–1·2 cm. longa, 1·5–3 mm. lata, vel non foliacea, 3–4 mm. longa, plana, haud carinata. *Torus* calycecum late campanulatus, 2·8 mm. longus. *Calyx* 5-dentatus, 0·25–0·35 mm. longus. *Corolla* 5 cm. longa; tubus basi manifeste inflatus; lobi lineari-lanceolati, 1·5 cm. longi, 1·5 mm. lati. *Filamenta* deflexa, 5 mm. longa; antherae 6 mm. longae. *Discus* calycem 0·8–1 mm. superans. *Stylus* parte incrassata 9 mm. longa.

South Africa. Transvaal: near Barberton, *Moore*.

1548. **Loranthus** (**Acranthemum**) **minor,** *Sprague* in Dyer, Fl. Cap. vol. v. sect. 2, p. 115, anglice [Loranthaceae]; affinis *L. natalitio*, Meisn., a quo ramulis abbreviatis minute puberulis, foliis minoribus minus coriaceis, corolla minore gracillima, disco quam calyce multo breviore, stylo filiformi recedit.

Rami graciles, cinerei vel griseo-brunnei, infra 2 mm. diametro 15 cm. infra apicem, ramulos abbreviatos in axillis foliorum lapsorum gerentes; ramuli pallide brunnei, 1–1·5 mm. diametro; ramuli abbreviati basi inconspicue perulati, minute puberuli, 2–3 paria foliorum gerentes, umbella terminati. *Folia* opposita, petiolata, ovato-lanceolata vel ovata, 1·8–3·1 cm. longa, 0·8–1·2 cm. lata, apice obtusa vel rotundata, basi obtusa vel cuneata, tenuiter coriacea, glabra, paullum supra basin trinervia, nervis inconspicuis; petiolus 1·5–4 mm. longus, gracilis. *Umbellae* 2–5-florae; pedicelli 6–8 mm. longi, graciles; bractea a basi patelliformi unilateraliter producta, 1–1·3 mm. longa, oblonga, valde concava, nonnonquam fere cymbiformis, apice obtusa, rotundata vel truncata, crasse obtuse carinata. *Flores* pentameri. *Torus* calycecum campanulatus, 2·5 mm. longus. *Calyx* 0·5 mm. longus annulo intramarginali incluso, subtruncatus. *Corolla* in alabastro linearis, supra medium latior, superne leviter clavata, acute acuminata, usque ad 5 cm. longa. *Filamenta* 5–6 mm. longa, superne ventraliter incrassata, parte incrassata oblonga 0·8 mm. longa; antherae lineares, 5–7 mm. longae, connectivo rotundato. *Discus* calyce multo brevior. *Stylus* filiformis, stigmate ovoideo fere 1mm longo.—*L. natalitius*, var. *minor*, Harv. in Harv. et Sond. Fl. Cap. vol. ii. p. 576 (errore sub *L. Zeyheri* impressus); Wood, Handb. Fl. Natal, 115.

South Africa. Natal: Mooi River, *Gerrard* 1434; banks of Umtwalumi River, on *Clausena inaequalis*, Benth., *McKen* 1863;

Umzinyati, *Wood* 1320; Alexandra District, Dumisa, *Rudatis* 1120. Zululand: Qudeni Forest, 1800 m., *Davis in Herb. Wood* 8608.

1549. **Loranthus** (**Infundibuliformes**) **Bolusii,** *Sprague* in Dyer, Fl. Cap. vol. v. sect. 2, p. 115, anglice [Loranthaceae]; affinis *L. Lugardii*, N. E. Brown, a quo umbellis breviter pedunculatis, corolla basi inflata differt.

Planta glabra. *Rami* teretes, cinerei, dense lenticellati; ramuli subangulares, brunnei, circiter 1·5 mm. diametro 15 cm. infra apicem; internodia 0·8–2·5 cm. longa. *Folia* opposita vel alterna, petiolata, oblongo-lanceolata vel lanceolata, 4–7 cm. longa, 1–1·6 cm. lata, apice minute apiculata vel obtusa, in basin angustata, rigide coriacea, paullum supra basin trinervia, nervis supra leviter elevatis subtus minus obviis; petiolus 3–5 mm. longus. *Umbellae* axillares, solitariae, breviter pedunculatae, 4–5-florae; pedunculus crassus, 1–1·5 mm. longus; pedicelli 1–1·3 mm. longi; bractea cupularis, lobo dorsali deltoideo, margine dorsali 1·5 mm. longo calycem aequante, margine ventrali 1 mm. longo. *Flores* pentameri. *Torus* calycecum turbinatus, 1·8 mm. longus. *Calyx* truncatus, 0·7 mm. longus. *Corolla* 2–2·3 cm. longa; tubus unilateraliter vel irregulariter findens, ampulla suprabasali ellipsoidea 2·5 mm. longa, supra ampullam per 1·5 mm. constricta, deinde ad apicem ampliata; lobi erecti, lineari-spathulati, 1–1·2 cm. longi, 0·7 mm. lati. *Filamenta* 3 mm. supra basin corollae loborum inserta, deflexa, sensim angustata, 5·5 mm. longa; antherae lineares, 1·8 mm. longae. *Discus* pentagonus, haud lobatus, 0·25 mm. altus. *Stylus* filiformis; stigma depresso-globosum, 0·7 mm. diametro.

South Africa. Portuguese East Africa: Delagoa Bay; 18 miles from Lourenço Marques, *Bolus* 9764.

1550. **Viscum** (**Ploionixia**) **pulchellum,** *Sprague* in Dyer, Fl. Cap. vol. v. sect. 2, p. 123, anglice [Loranthaceae]; affinis *V. obovato*, Harv., a quo petalis floris ♀ lanceolato-oblongis torum aequantibus, stylo longiore differt.

Rami subteretes, graciles, infra 2 mm. diametro 15 cm. infra apicem; ramuli gracillimi, 1·2–6 cm. longi, subangulati, minute papillati, internodiis 0·5–1·2 cm. longis. *Folia* distincte petiolata, late obovata, apice rotundata vel obtusa, in basin subcuneata, 0·6–1·2 cm. longa, 4–8 mm. lata, coriacea, glabra, obsolete 3-nervia, nitidula; petiolus 1–2 mm. longus. *Inflorescentia* ♂ haud cognita. *Inflorescentia* ♀: Cupulae bracteales axillares, sessiles, solitariae vel geminatae, flores singulos gerentes, distincte bilabiatae, labiis sub angulo recto vel minus divergentibus, 1–1·3 mm. longae, medio 0·5–0·7 mm. altae, margine interiore grosse glanduloso-ciliatae. *Torus* anguste campanulatus, 1·3 mm. longus, 0·8–0·9 mm. diametro. *Petala* lanceolato-oblonga, subacuta, 1·3 mm. longa. *Stylus* cum stigmate 0·8 mm. longus. *Bacca* ellipsoidea, 4 mm. longa, subtiliter verrucosa.

South Africa. Natal: Tugela River, *Gerrard* 1649.

VIII.—THE CARE OF OLD TREES.

W. J. BEAN.

(With Plates.)

The number of inquiries received at Kew as to the best treatment for trees decayed in the trunk, or showing evidences of decline by their poor growth or thin foliage, points to a wide interest in the subject. As a matter of fact there are few gardens or parks of any considerable extent which do not contain trees whose size or rarity, or perhaps associations, give them a peculiar value in their owner's eyes. The longevity of a tree, even if it be of the commonest species, endows it with an individuality of its own and makes it capable of inspiring sentiments and creating memories to which few shrubs and no herbaceous plant can ever lay claim. It is not, therefore, surprising that there is a widespread desire to know how the decreasing vigour of such trees may be revived. There is not the least doubt that the term of years of many trees is shortened by neglect due to ignorance.

The three most powerful agencies that bring about the destruction or decline of trees are wind, failing food supply, and fungoid parasites.

Wind.—As regards storms, the matter, so far as existing large trees are concerned, is to a considerable extent out of one's hands. Trees that suffer most are those whose main trunk forks low down, separating there into two or more great limbs and dividing the head of the tree into several distinct sections. With trees in exposed positions there comes a wind-storm sooner or later that starts a crack in the fork. Moisture, parasitic fungi and decay follow in turn, and eventually one section of the head of the tree comes to the ground. The prevention of the forking of trees is, of course, a matter that should be attended to in the early stages of their growth. Neglected then, it is difficult, or perhaps impossible to remedy afterwards. It is, in fact, the most important item in the management of large-growing trees in their young state, and consists in keeping the tree to a single leader as long as it is reasonably accessible, by suppressing all rivals, thereby laying the foundation of a tall, straight trunk or main axis capable of supporting the whole head of branches. Large trees that are in danger through having been neglected in this respect may be assisted in two ways. They may (1) have the strain on the limbs lessened by reducing the top-growth; and (2) the main limbs may be made to give each other mutual support by being braced together.

The first of these operations is almost entirely a matter of judgment exercised on the spot. Unduly heavy branches may, however, be rendered safe for many years by the use of the saw. The top-growth of pretty nearly every tree is capable of being considerably reduced without in the least destroying its shapeliness or characteristic form. It is an operation needing taste and care, and consists chiefly in removing branches either clean back to the limb or back to the place where they join another and perhaps larger branch. Merely stubbing back the branches and leaving stumps must be avoided.

Artificial support of Limbs.—The bracing together of large limbs is done in two ways. The commonest method is by placing a collar of iron round each limb and joining them by a stout chain or iron rod fitted with a screw arrangement for tightening up. This plan is quite efficacious, but the collars need watching. As the limb increases in girth the collar becomes too small, and, if left too long, becomes imbedded in it (*see* Plate I, fig. ii). It is best to make a collar with a hinge, so that it can be adjusted to the increasing girth of the limb; also to move it up or down every five years or so. Another plan equally effective for all but resinous conifers, and practically permanent, has been employed at Kew during the past fifteen years. In this the collar is dispensed with. A hole is bored right through each limb with an auger large enough to admit an iron rod $\frac{3}{4}$ to $1\frac{1}{4}$ ins. thick, "threaded" at each end, which must be long enough to reach from limb to limb and protrude a little beyond the outside of each. It is necessary, of course, that the holes should be on the same alignment. Any slight error in this respect can, however, be overcome by bending the rod. A stout iron plate curved to fit the circumference of the branch is now placed at each end of the iron rod and made to set close to each limb by means of a screw-nut and the whole thus braced together. The weight of each limb is thereby supported by the iron plate instead of a collar (*see* Plate I, fig. i). If, in course of time, the wood should close over the plate no harm would be done, rather the reverse. The iron rod should fit the auger-hole as closely as possible, and it should be heavily smeared with coal tar before it is thrust through the limb—the object being to make the opening air- and water-tight. This plan has been adopted for a good number of insecure limbs of trees in Kew, such as beeches, Sophoras, oaks and Crataegus; in no case have any evil effects been noticed. It has not been employed for resinous trees for fear of persistent bleeding. Some people regard the boring of the auger-hole right through the heart of the limb as a barbarous proceeding. But anyone acquainted with the elementary characteristics of tree-growth knows that it is not so. The vital processes connected with growth and the deposit of new wood are located just beneath the bark. A tightly clasping collar is much more likely to interfere with them than a cleanly bored hole. Practically the only disadvantage the latter involves is a slight reduction of the resisting power of the limb to external strain at that particular part.

Watering and Feeding the Roots.—Long spells of excessive drought undoubtedly hasten the end of many trees that have reached their period of decline. This was very evident to dwellers in the lower Thames Valley by the great number of dead trees that could be seen in hedgerows and elsewhere during the succession of dry summers about twenty years ago. When an artificial supply of water is available, rare or valuable trees can be greatly helped by employing one or other of the various "sprinklers" which distribute the water in the form of rain. To effect any real benefit the soil should be thoroughly moistened all through, and, for a big tree, the water should run for at least twenty-four hours, or, still better, two or three days. It is remarkable, nevertheless, how much less effective artificial watering is

than the natural rainfall. During a hot, dry spell, evaporation is so great that one may apply water to the roots of a tree in quantities equivalent to what it would receive from the entire rainfall of a wet summer, and yet the process will bear repeating in a few weeks. Few trees are more benefited by a generous water supply than conifers of the *Cupressinae* group (*Thuya*, *Cupressus*, etc.). The cypresses at Kew have for several years past been given liberal supplies of water by means of irrigators or "sprinklers" in the early summer without regard to the natural rainfall, and the result has been a remarkable improvement in their vigour. It has also had the effect of staying the attacks of a scale insect that was proving very troublesome. Old cedars growing on light soils also derive much benefit from copious waterings during dry spells.

Mulching.—The majority of places, however, have no water supply of a kind that can be utilised for the watering of trees to this extent. The alternative method then is mulching or "top-dressing." On the whole, this is more permanently effective than artificial watering, but is difficult to adopt for trees situated on lawns, as are so many notable trees. There is no doubt that cultivating the area of soil occupied by the roots of a tree, *i.e.*, keeping the surface open, loose and free from weeds or grass is extremely beneficial; and for trees giving indications of starvation at the roots a mulching of four to six inches of decayed leaves, loam, farmyard manure, or a mixture of these, will be found of great additional benefit. On surface-rooting trees like beech and horsechestnut the invigorating effects of such a top-dressing are remarkably evident, even during the first season.

In the case of trees whose branches do not reach the earth, the disfigurement to a trimly-kept lawn of a large patch of bare or mulched ground would prevent many people adopting the surface-cultivating process. At Kew, where many valued trees with clean, exposed trunks are growing on shaved lawns, a sort of compromise is adopted. About the time of the fall of the leaf, the turf is taken off and used elsewhere to repair worn patches caused by the summer's traffic. The bared surface is then pricked over with a fork as deeply as can be done without injuring the roots and a four-inch dressing of manure put on the top. The ground is then left exposed to rain and frost until the following April, when the manure is forked in and the ground trodden down and sown with grass seed. Without placing too implicit a reliance on the stories of the wonderful, but very elusive, "poison" supposed to be emitted by the roots of grasses—there are tens of thousands of magnificent trees growing in parks and on lawns that manage to survive it—there is no doubt that the growth of grass is very detrimental indeed to the progress of young trees. This has been known to generations of cultivators. In my opinion it is entirely due to the reduced aeration of the soil, and to the grass absorbing the rainfall and preventing its reaching the tree roots at the season, early summer, when they most need it. In a place like Kew especially, where some of the lawns have been undisturbed for decades and in the meantime trodden by innumerable feet, the soil has become very consolidated for two or three inches at the top. In such places, when once the ground becomes dry in summer, it

takes a heavy and continuous fall of rain to penetrate to the roots again. After a dry period I have frequently noticed that even a day's persistent rain will not penetrate more than two or three inches below the surface on some of our lawns. It is evident enough, therefore, how a failing tree may be benefited by having the hard surface soil broken up, even if the turf be relaid. Still more if it can be kept permanently open and cultivated.

Parasitic Fungi.—Probably neither storms nor root-starvation hasten the end of trees so much as parasitic fungi. It is often their attacks that fatally reduce the wind-resisting power of trees. In its bark the tree is endowed by nature with an armour capable of resisting fungoid attack. But this armour is often pierced by breakages, by insects and, in gardens, through bad pruning. Cultivators who especially treasure a particular tree should see that its "skin" is maintained whole. Whenever a wound appears measures should be taken to heal it. The most vulnerable part of a tree, of course, is its trunk, then its main limbs. The outer extremities do not matter so much, although it is often possible for disease to start there and gradually creep inwards to the main limbs and trunk.

In travelling about the country it is evident to any one who has any knowledge of this matter, that the most common cause of decay is due to neglect of snags. Hollow trunks, or decayed cavities have invariably their origin in neglected stumps left by branches being broken off by wind, or to that curious propensity many people who prune off branches have to leave stumps a few inches long, instead of sawing them clean back to the trunk or limb from which they spring (*see* Plate II, fig. iii).

It may be stated as an axiom that when a branch has to be removed, or when the stump of a branch is left through breakage by wind, it must be cut right back to, and in line with, the circumference of the trunk or larger branch to which it has been attached. The new bark which it should be one's aim to encourage to grow over the wound and thus make it secure against decay, will do its work most quickly when no stump is left. A stump may sometimes be left short enough for the new bark to grow over it, but, if more than an inch or two long (according to the size of the trunk) the bark will never cover the wound, decay sooner or later is set up, damp enters, and a cavity begins to form. After a while this will become large enough to hold water and then, as one may imagine, decay is doubly rapid.

Even when the amputation has been done in the best way, the raw surface of the wound is still a source of danger as the landing-place for the spores of parasitic fungi. Especially is this the case with soft woods like lime and horsechestnut. The best preventive is a good coating of ordinary coal tar applied at once. This substance forms an air-tight and water-tight covering and effectually disposes of any danger from fungi. The wound should be examined again a few months after it has been made, and if necessary a fresh coat of tar put on. Wounds sometimes crack through summer heat, and the openings should be filled in with tar and made water-tight. The tar, in fact, acts as a temporary bark until the new bark extends over the wound, and it should be

renewed as often as may be necessary until that is accomplished. This applies to all wounds on trees, however caused.

There still remains to be considered the treatment of cavities that have been allowed to form. As a matter of fact, in very few of the cases we are asked to advise upon is it prevention of decay that is in question. Almost invariably it is how to deal with trouble already in existence and due to neglect.

No treatment will ever enable a tree to fill up a cavity with sound wood. All that can be done is to arrest the mischief and prevent, if possible, further decay.

The first thing is to clean out thoroughly all the decayed wood (often reduced to a sodden mass) from the cavities. If possible it should be cleaned out right back to the hard wood; if the wood be sound it does not matter if it be dead. Very frequently, in long neglected wounds, a deep, narrow, well-like cavity has formed by decay, which it is impossible to get thoroughly clean and dry by working from the top. In this case, the best plan is to find by poking with a piece of stout wire how deep down the trunk the cavity extends. Then an auger-hole should be bored from the outside in a slanting direction upwards so as to reach the bottom of the hole thus located. This will enable all the moisture, etc., to drain out. When the walls of the cavity are reasonably dry (it may take a few days for them to become so, but there is no need to hurry) they should be washed with a solution of carbolic acid. This solution is made by adding one part of "commercial" carbolic acid (liquid) to twenty parts of methylated spirits. This is intended to penetrate into the walls of the cavity and kill any fungoid growth that may remain. It soon dries and the wood must then be coated over with a generous layer of coal tar. It now remains to fill up the hole and make it water-tight. On the whole we have found Portland cement the most convenient "stopping," although asphalt has been recommended. Where the hole is large, cement is apt to crack, and may thus require looking to occasionally. The cement, or whatever stopping is used, should not be allowed to fill up the cavity so as to close in the roll of new bark which will, if the stump be a short one, nearly always be found there. (If the stump be a long one, it must be sawn off close, as advised above.) This roll of new bark represents the attempt of the tree to close up the cavity. It has not succeeded because the new bark has lacked a surface on which to set itself, such as would have been provided by the sawn surface of the wound had it been protected from decay, and such as is now provided by the cement. The hole, therefore, should only be filled up sufficiently to reach the lower side of the roll (*see* Plate II, fig. iv). The tree is thereby enabled to lay its new bark and wood over the cement, and eventually to hermetically seal up the old opening of the cavity.

Where the hole is very large the aid of the bricklayer may be obtained. In the *Kew Bulletin* of 1912, p. 338, two illustrations of the building up of such a hollow by bricks and mortar are given. These and the accompanying text may be consulted.

Fungi on Roots.—The attacks of fungi on roots are the most subtle and deadly of all. As a rule the damage is beyond remedy before it is discovered. Fortunately it is rare in comparison with

PLATE I.

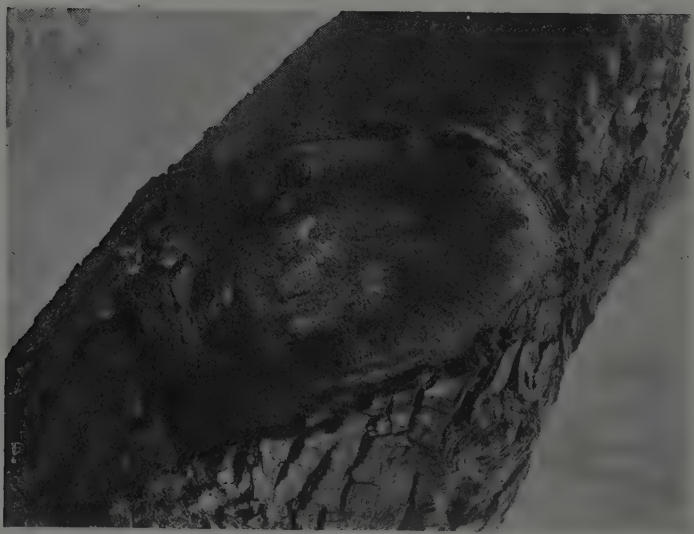
I.

II.

[*To face page* 86.

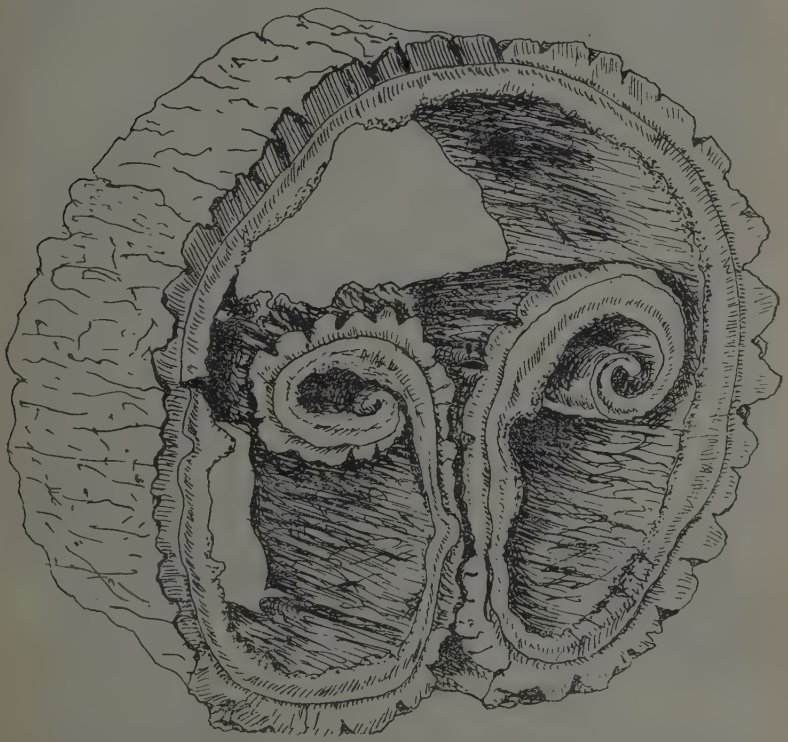
PLATE II.

III.



IV.

stem and branch disease. The only practical advice that can be given now is that all roots severed or barked during ground work near trees should have the wounds coated with coal tar as advised for branch wounds.



Portion of an Elm trunk from Elveden Park, Suffolk, now in Museum IV. Kew. This is a very remarkable example of the persistency of a tree trying to close up a cavity in its trunk by the continued formation of new bark. It shows the necessity of assisting a tree to close up a wound by providing it with a solid surface on which its new bark can be laid.

EXPLANATION OF PLATES.

Plate I.

Fig. I.—*Sophora japonica* (one of the original trees at Kew introduced in 1753). The limbs are supported together by iron rods and plates as described in the text. Lower down on the central limb is a constriction caused by allowing an iron collar to remain too long in one place.

Fig. II.—Portion of the limb of a tree preserved in Museum IV. at Kew, showing the result of neglecting a supporting iron collar. Not only has the collar itself become embedded, but also a link of the chain to which it was attached.

Plate II.

Fig. III.—A neglected wound on a walnut tree. Here is very clearly shown the evil of leaving a stump when pruning, instead of cutting it close back as advised in the text. The tree, as may be seen from the roll of

new bark all round the wound, has made an attempt to close up the wound, but failed on account of the stump several inches long being left.

Fig. IV.—The same, after being cleaned out, antiseptically treated and filled with Portland cement. It is interesting as showing the correct amount of "stopping" to use. The cement should only come up to the *lower* side of the roll of new bark which is now provided with a surface over which it may extend.

IX.—DECADES KEWENSES

Plantarum Novarum in Herbario Horti Regii Conservatarum.

DECAS LXXXIV.

831. **Eriolaena Lushingtonii,** *Dunn* [Sterculiaceae-Eriolaeneae]; *E. quinqueloculari*, Wight, affinis, foliis membranaceis, alabastris medio constrictis distincta.

Arbor, partibus herbaceis stellato-pubescentibus. *Folia* orbicularia, cordata, acuta, 4–5 cm. longa, irregulariter breviter dentata, supra pilis stellatis conspersa, infra albo-vestita, petiolis lamina bis vel ter brevioribus. *Flores* pedunculis axillaribus longis 2–3-floris gesti; bracteolae in filamenta tomentosa multa fissae, 4–5 mm. longae, caducae, distantes et ad gemmas maturas haud accedentes. *Sepala* 5, basi connata, ligulata, 2 cm. longa, intus pubescentia, extra tomentosa. *Petala* 5, decidua, anguste obovata, unguibus tomentosis dilatatis exceptis glabra. *Columna staminalis* versus apicem in series paucas filamentorum fertilium divisa; antherae erectae, lineares. *Staminodia* 0. *Ovarium* sessile, circiter 7-loculare; loculi multi-ovulati; stylus simplex, apice in stigmata 7 parva divisus. *Capsula* lignosa, ovata, breviter acuminata, loculicide dehiscens. *Semina* loculo quoque 5–8, adscendentia, superne in alam producta.

India. Madras Presidency, Nallamalais, Cheloena (Kurnool District), *A. W. Lushington.*

832. **Indigofera polygaloides,** *Scott* [Leguminosae-Galegeae]; ab *I. trita*, Linn. f., habitu graciliore, racemis longissimis tenuoribus nunquam foliis brevioribus, indumento minus denso recedit.

Herba gracilis, 40–50 cm. alta; caules plures, adscendentes, superne quadrangulares, appresse albido-hirsuti, basi fusco-brunnei ceterum pallido-virides. *Folia* petiolo 5–8 mm. longo gracillimo hirsuto suffulta, trifoliolata; foliola oblongo-elliptica, basi apiceque obtusa, brevissime mucronulata, utrinque pilis medifixis brevibus circiter 0·5 mm. longis albis induta, costa supra depressa subtus prominenter elevata pilis albis dense induta, nervis lateralibus supra subdistinctis subtus obscuris; foliola terminalia 2–2·7 cm. longa, 5·5–7 mm. lata, petiolulo 5–7 mm. longo suffulta, lateralia 1·4–1·9 cm. longa, 4–5·5 mm. lata, petiolulis 1 mm. longis; stipulae lineares, 1·5–2 mm. longae, pilosae. *Racemi* axillares, 7–13 cm. longi, multiflori; rhachis pilis minutissimis albidis induta; bracteae minutae, 1·5 mm. longae, pilosae, sub anthesi deciduae; pedicelli ad 1 mm. longi, pilis albis

appressis induti. *Calyx* dense albido-pilosus; tubus 1 mm. altus; lobi lineares, acutissimi, 2·5 mm. longi. *Vexillum* sessile, ovatum, apice rotundatum, 5 mm. longum, 3·5 mm. latum, extra breviter albo-pubescens; alae lanceolatae, apice rotundatae, 4·5 mm. longae, 1·5 mm. latae; carina oblonga, apice rotundata, 4·5 mm. longa, 2 mm. lata, appendicibus lateralibus subulato-lanceolatis curvatis 1 mm. longis instructa. *Stamina* fere 3·3 mm. longa; antherae fere 0·5 mm. longae, apice glandulo subulato minutissimo albido ornatae. *Legumen* juvenile sessile, lineare, 1·5 2 mm. longum, fere 1 mm. latum, apice stylum persistentem gerens, dense breviter villosum. *Semina* multa, orbicularia.

North Australia. Pine Creek: near Darwin, Feb. *C. E. F. Allen* 85.

833. **Dolichos errabundus,** *Scott* [Leguminosae–Phaseoleae]; a *D. falcato*, Klein, foliolo medio haud triloboto, inflorescentia longiore, floribus in inflorescentiae ramis singulis recedit, et a *D. bifloro*, L., caule foliisque minus pubescentibus, et floribus distincte pedunculatis distinguendus.

Herba errabunda, semiprostrata, caule angulato leviter albo-pubescente. *Folia* petiolo 1–2 cm. longo albido-pubescente suffulta, trifoliolata; foliolum medium ovatum, apice subacutum, basi subcuneatum, petiolulo 9 mm. longo piloso stipellato stipellis 2 lanceolatis 1 mm. longis 1·5 2 mm. infra basin folioli positis suffultum; foliola lateralia oblique oblongo-ovata, subacuta vel obtusa, petiolulo 1 2 mm. longo suffulta; omnia costa nervisque pagina superiore subdistinctis pagina inferiore elevatis prominentibus pallidis distinctissimis ut marginibus pilis paucis albidis indutis; stipulae lanceolatae, acutae, fere 4 mm. longae, striatae, pubescentes, persistentes. *Inflorescentia* terminalis, elongata, efoliata, 15-35 cm. longa, pauciflora, internodiis 6 8 cm. longis; flores pauci, magni, pedunculis unifloris 1–2 cm. longis pilis albidis indutis; pedicellus dense pubescens, 0·5-2 mm. longus; bracteolae magnae, ovatae, 5·5-6 mm. longae, 3·5–4 mm. latae, pubescentes, virides, venis parallelis fusco-rubris. *Calyx* campanulatus, dense pubescens; lobi ad 2 mm. longi. *Corolla* glabra; vexillum obcordatum, 1·4 1·6 cm. longum, 1·4–1·7 cm. latum, ungue fere 2 mm. longo apice utrinque auriculato; alae oblique oblongae, apice rotundatae, 1·5–1·7 cm. longae, 6·5 mm. latae, ungue 2 3 mm. longo; carina oblique oblonga, apice rotundata, 1·35–1·5 cm. longa, 6–7 mm. lata, ungue fere 3 mm. longo. *Stamina* 1·6 cm. longa; filamenta tenuissima et subtranslucentia; antherae ovoideae, 1·5 mm. longae. *Stylus* glaber, paullo stamina superans; stigma minutum.

North Australia. Bachelor Farm: near Darwin, Dec. *C. E. F. Allen* 5.

C. E. F. Allen 52 is a form of the same species, but apparently from having grown in a somewhat different habitat its leaves are smaller and more obtuse; the inflorescence and flowers, however, are identical with those of the type.

834. **Rosa (Systylae) cerasocarpa,** *Rolfe*; a *R. longicuspidi*, Bert., foliolis paucioribus et majoribus, sepalis angustioribus et fructibus minoribus differt.

Frutex scandens vel subscandens, alta. *Rami* glauci vel subglauci, aculeis validis recurvis basi late dilatatis sparse armati. *Folia* 12–18 cm. longa, 5-foliolata vel rarissime 3-foliolata; rhachis breviter glandulosa et sparse aculeata; foliola breviter petiolata, ovata vel elliptico-ovata, acuminata, argute serrata, glabra vel subglabra, subcoriacea, subtus glaucescentia, venis prominentibus, 5–10 cm. longa, 2·5–5 cm. lata; stipulae adnatae, angustissimae, apice liberae, divergentes et acuminatae, marginibus sparse glandulosis. *Flores* 2·5–3 cm. diametro, in cymas terminales corymbiformes 8–15 cm. diametro et multifloras dispositi; pedicelli 2–4 cm. longi, crebre glandulosi. *Receptaculum* anguste obovoideum, 4 mm. longum, villosum et glandulosum. *Calycis* lobi oblongo-lanceolati, acuminati vel caudato-acuminati, pubescentes et glandulosi, interdum pinnatisecti, 7–8 mm. longi, reflexi. *Petala* cuneato-obcordata, alba, circiter 1·2 cm. longa. *Filamenta* glabra, 7–8 mm. longa. *Carpella* copiose villosa; styli in columnam connati, 6 mm. longi. *Fructus* globosus, saturate ruber, circiter 1 cm. longus, calycis lobis et stylis deciduis.

China. Ichang, *A. Henry* 2952; North Patung, *A. Henry* 7007.

Flowered in the collection of Sir W. T. Thiselton-Dyer, K.C.M.G., The Ferns, Witcombe, Glos., in June, 1914, when flowering specimens were sent for determination, with the information that the plant was obtained from China through Sir Thomas Hanbury, La Mortola. Fruits were sent in the following November. It is allied to *R. Sinowilsoni*, Hemsl., and the Indian *R. longicuspis*, Bert., but is readily distinguished by its smaller more numerous fruits, narrower sepals, and the larger fewer leaflets.

835. **Centratherum burmanicum,** *Gamble* [Compositae–Vernonieae]; ab omnibus speciebus Peninsulae Occidentalis foliis majoribus infra viridibus, bracteis exterioribus longis aristatis, interioribus obtusis scariosis differt.

Herba perennis, ad 1 m. alta, ramosa, ramis striatis sparsim hispidis, internodiis 5–10 cm. longis. *Folia* sessilia, lanceolata, apice et basi longe acuminata, 15–20 cm. longa, 5–6 cm. lata, marginibus basi excepta serratis, pagina utraque parce scabride hispida; nervi utrinque 10–12; reticulatio haud conspicua. *Capitula* axillaria vel terminalia, singula vel raro ad 3 in pedunculo communi ad 10 cm. longo, circa 2 cm. diametro; bracteae exteriores multae, virides, lineares, apicibus recurvatis aristatis, ad 1 cm. longae, interiores breviores, scariosae, cuneatae, apicibus obtusis triangularibus dentatis purpureo-striatis. *Corolla* tubularis, 7–8 mm. longa, inferne hyalina, ad tertiam partem fissa, lobis nigro-purpureis. *Antherae* paullo exsertae, supra acutae, infra obtusissime auriculatae. *Styli* graciles, lineares, exserti. *Achaenia* oblonga vel obovoidea, apice truncata, conspicue 10-costata; pappus brevissimus, caducissimus, scaber.

Burma. Southern Shan States: Taunggyi Reserve; in high grass on limestone at about 1500 m., *W. A. Robertson* 434.

836. **Stylidium induratum,** *Scott* [Stylidiaceae]; a *S. bulbi-*

fero, Benth., habitu compactiore, foliis brevioribus carnosioribusque, et floribus minoribus differt, et a *S. Dielsiano*, E. Pritzel, foliis costa subtus crassa et prominente, et floribus minus glanduloso-pubescentibus facile distinguendum.

Planta perennis, 5–7 cm. alta, valde et divaricate ramosa, repens, radicibus 7–11 cm. longis. *Caules* veteres 1–4 cm. longi, nudi, glabri, atri, cortice atro interdum unilateraliter fisso et caduco, bulbis defoliatis incrassatis fuscis; juveniles 1–1·5 cm. longi, straminei, glabri, folia pauca gerentes. *Folia* rosulata, plerumque 9–12 conferta, paucis caducis inter bulbos dispositis, linearia, sessilia, basi gibboso-incrassata, bulbum pallidum demum fuscum vel atrum formantia, apice acuta, 4·5 mm. longa, 0·75 mm. lata, carnosa, subteretia vel triquetra, glaberrima, marginibus indurato-incrassatis albis dentibus minimis levissime serrata; costa subtus versus apicem conspicua, incrassata, indurata, apice mucronem subulatum, 0·5–1 mm. longum formans. *Rhachis* fusca, leviter glanduloso-pubescens, 0·8–1·5 cm. longa, flores 3–6 gerens. *Flores* subsessiles vel pedicellis 1 mm. longis suffulti; bracteae 1 mm. longae. *Calyx* 5·5 mm. longus, levissime glandulosus; tubus fuscus; lobi 1–1·25 mm. longi, lanceolati, obtusi, fere aequales sed duo fere ad apicem connati, tubo pallidiores. *Corollae* tubus 5–6 mm. longus, calycis lobos superans; lobi lanceolati, obtusi, eglandulosi, omnes fere aequales, 3–5 mm. longi, 1 mm. lati; labellum parvum, tenue, basi appendicibus 2 labello paulum longioribus flexuoso-subulatis instructum. *Columna* tenella; antherae ovatae.

West Australia. Victoria Desert: Camp 54, Sept. *R. Helms* (Elder Exploring Expedition).

837. **Stylidium Stowardii,** *Scott* [Stylidiaceae]; a *S. breviscapo*, R. Br., inflorescentia glandulosa differt, et a *S. Dielsiano*, E. Pritzel, foliis teretibus carnosisque, bulbis atris nec pallidis, labello inappendiculato facile distinguendum.

Planta perennis, parva, repens, 4–6 cm. alta, valde et divaricate ramosa, radicibus fere 8 cm. longis. *Caules* veteres 2 cm. longi, atri, nudi, glabri, bulbis defoliatis incrassatis atris; iuveniles conferti, 1–2 cm. longi, rubri, glabri. *Folia* rosulata, plerumque 9–12 conferta, pauca caduca inter bulbos disposita, linearia, basi dilatata vaginis incrassatis demum rubris bulbos atros formantibus, apice acuta et minute apiculata, 5 mm. longa, 0·75 mm. lata, carnosa, rugosa, teretia, glaberrima, sessilia. *Inflorescentiae* rhachis rubra, leviter glanduloso-pubescens, 1–2 cm. longa, flores 3–6 gerens. *Flores* plus minusve glandulosi, pedicellis 2–4 mm. longis suffulti; bracteae 2 mm. longae, leviter tomentosae. *Calyx* 5 mm. longus, glandulosus; tubus leviter obliquus, ruber; lobi 1–1·5 mm. longi, lineari-lanceolati, obtusi, paulum inaequales. *Corollae* tubus 6 mm. longus, tenuis; lobi glandulis paucis induti, valde inaequales, albi, fauce rubro-maculati; antici oblique oblongo-obovati, 3·5–4 mm. longi, 1·5 mm. lati, postici obovati, 1·5 mm. longi, 1 mm. lati; faux nuda; labellum ovato-orbiculare, minutum, 0·5 mm. diametro, inappendiculatum, carnosum, rubrum. *Columna* tenella; antherae ovatae, fere 1 mm. longae.

West Australia. Nangeenan, *Stoward* 121; between Perth and Coolgardie, Railway between Cunderdin and Dedari, *Thiselton-Dyer* 87.

838. **Gnetum Kingianum,** *Gamble* [Gnetaceae]; *G. funiculari*, Blume, affinis, sed foliis siccitate nigris, reticulatione minus areolata et fructibus obtusis differt.

Frutex magnus, scandens, cortice brunneo lenticellato ad nodos multum incrassato; ramuli modice crassi, conspicue lenticellati. *Folia* elliptica vel elliptico-ovata vel ovato-oblonga, apice breviter abrupte cuspidato-acuminata, basi angustata vel rotundata, 10–20 cm. longa, 6–12 cm. lata, coriacea, pagina utraque siccitate nigra, superiore lucida; costa crassa, supra impressa, infra prominens; nervi utrinque 8–10, paulo prominentes, primum fere recti, marginem versus arcuatim juncti; reticulatio irregularis, conspicua; petiolus crassus, supra canaliculatus, circa 0·8–1·5 cm. longus. *Spicae* ♂ cylindricae, apice acutae, 2 cm. longae, in paniculis ad ramulorum nodos fasciculatis; pedunculi paulo complanati, bracteis duabus acutis ad medium et etiam infra spicam instructi; bracteae cupulares arcte connexae, intra pilis mollibus brevibus septatis ornatae. *Perianthium* elongatum, clavatum, quadrangulum. *Filamentum* breve, crassum, antherarum thecis globosis. *Spicae* ♀ 10–12 cm. longae, paniculatae, solitariae vel 2, e ramulorum vetustiorum nodis ortae; pedunculi circa 1·5 cm. longi; bracteae connatae; bracteae cupulares ut in spicis masculis. *Ovulum* ovatum, longe acutum. *Fructus* in spicas ad 20 cm. longas paniculatas solitarias vel e ramulis vetustioribus fasciculatas dispositi, ellipsoidei, aliquando primum apice paulo acuti, tum apice et basi obtusi, 2–2·5 cm. longi, 1·5–1·7 cm. diametro, vivi flavescentes vel rufescentes, siccitate nigri et reticulati; pedunculi lenticellati.

Malay Peninsula. Perak: Kota Larut, *Wray* 2851; Gunong Batu Patch, 1000 m., etc., *Wray* 917, 1641, 1966, 2993; in forest in various places up to 600 m., *King's Collector* 4031, 4893, 4942, 6699, 10,954. Negri Sembilan: Bukit Danar, *Cantley* 607. Malacca: Selandor, *Cantley* 471. Singapore, *Ridley* 4918, 8074, 9126, *Goodenough* 1612.

839. **Gnetum Wrayi,** *Gamble* [Gnetaceae]; a speciebus aliis malayanis foliis conspicue reticulatis, fructu ellipsoideo-oblongo 6 cm. longo conspicue maculato differt.

Frutex alte scandens, cortice brunneo lenticellis pallidis conspicuis notato; ramuli graciles, teretes, internodiis 4–6 cm. longis. *Folia* elliptica vel elliptico-ovata, apice plerumque abrupte caudato-acuminata, basi rotundata vel attenuata, 7–12 cm. longa, 3–5 cm. lata, coriacea, supra lucida, infra lucida et reticulata, costa conspicua supra impressa; nervi utrinque circa 10, obscuri, intra marginem arcuatim juncti, reticulatione minute areolata; petiolus 6–7 mm. longus. *Spicae* ♂ per paria e nodis ramulorum superiorum efoliosis ortae, cylindricae, 1·5–2 cm. longae; pedunculi paris utriusque inaequales, superioris 7 mm., inferioris 4 mm. longi; bracteae ovatae, acutae, connatae; bracteae cupulares patelliformes, marginibus integrae vel paulo crenatae, intra pilis

mollibus minute septatis ornatae, et flores ♂ et incompletos ♀ mixtos gerentes. *Perianthium* gracile, tubulosum, 1–1·5 mm. longum. *Stamen* longe exsertum, filamento gracili, antherarum thecis oblongis parallelis. *Flores* ♀ incompleti, oblongi, apice obtusi. *Spicae* ♀ etiam e nodis foliosis ortae, 3 cm. longae; verticilli distantes; bracteae cupulares patelliformes, basi inflexae, ut in ♂ pilis mollibus ornatae. *Ovula* ovoidea. *Fructus* sessilis, ellipsoideo-oblongus, utrinque angustatus, 6 cm. longus, pallide brunneus, maculis pallide lutescentibus ornatus.—*G. edule*, Ridley in Journ. Str. Br. Roy. As. Soc., No. 60, p. 64, *non* Blume.

Malay Peninsula. Pahang: Tahan river, *Ridley* 2329. Perak: Thaiping, Relan Tujor and Simpang, *Wray* 603, 1848, 2229, 3009; Larut, *King's Collector* 5283, 6590. Singapore, *King's Collector* 1237, *Ridley* 3958, 6126, *Hullett* 603.

840. **Digitaria orthostachya,** *Stapf et Jesson* [Gramineae-Paniceae]; inter species australienses et malayanas nulli arcte affinis, sed *D. monodactylae*, Stapf, habitu similis praecipue racemis solitariis, sed ab ea culmis annuis, racemis compositis et spiculis longius pedicellatis minoribusque, pedunculis pilosis differt.

Gramen annuum. *Culmi* tenues, teretes, erecti vel basi geniculati et ibi ramosi, 15–18 cm. longi, glabri, 3–4-nodi. *Foliorum vaginae* laxae, firmae, prominenter striatae, rufae, breviter hispidulae, ceterum praeter basin et partem superiorem subglabrae, omnibus nodis parce hirsutis; ligulae breves, membranaceae, minutissime ciliolatae; laminae lineares, superne tenuiter attenuatae, 2·5–9 cm. longae, usque ad 3 mm. latae, rigidulae, utrinque pilis tenuibus albidis rigidis raris instructae, costa prominula, nervis lateralibus multis tenuibus. *Racemi* compositi, spiciformes, solitarii; pedunculi pilis patentibus longis conspersi; rhachis gracilis, subflexuosa, triquetra, glabra; pedicelli graciles, pubescentes, ramosi, inferne plerumque 4-nati, 4–8 mm. longi, superne 2-nati, 3–4 mm. longi. *Spiculae* ovato-lanceolatae, cum callo obscuro 2 mm. longae, pilis adpressis sericeis albisque. *Gluma* inferior 0, superior lanceolata, 1 mm. longa, membranacea, subacuta vel subobtusa, 3-nervis, dorso ubique dense pilosa, pilis usque ad ½ mm. longis acutis. *Anthoecium* inferius vacuum: valva submembranacea, lineare-oblonga, 2 mm. longa, acuta, 7-nervis, dorso ad latera dense sericeo-pilosa parte media glabra; valvula minutissima, papillosa, obscure 2-nervis; anthoecium superius ♂: valva subchartacea, brunnescens, oblongo-lanceolata, subacuminata, ad margines late inflexa, tenuior, 2 mm. longa, 3-nervis, valvula valvae fere aequilonga, 2-nervis, flexuris basi sese obtegentibus. *Antherae* 1 mm. longae. *Styli* 1 mm. longi. *Stigmata* 0·5 mm. longa, lividia. *Caryopsis* ignota.

North Australia. Near Darwin: Bachelor Farm; grassy high land, *C. E. F. Allen* 29, Jan. 1914; near Darwin, grass in rocky land, *C. E. F. Allen* 143, March, 1914.

X.—MISCELLANEOUS NOTES.

Mr. George Brown Mould, a member of the gardening staff of the Royal Botanic Gardens, has been appointed by the Secretary of State for India in Council, on the recommendation of Kew, a probationer gardener for service in India.

William Barbey.—Botany has suffered a serious loss by the death of William Barbey which occurred on November 19, 1914. He was a member of a Swiss family which had been settled in Canton Vaud since the early years of the 15th century; his father however, spent many years in New York, where all the children except William were born. He, the youngest of the six, was born at Genthod, near Geneva, on July 14, 1842. His father was an austere man, and the Spartan training which young William received nearly broke him physically and left its mark on his character in many ways. Up to his twentieth year he was educated at Geneva. After that he went to Paris to study engineering at the École Centrale, but illness compelled him to abandon his studies in 1864. For two years he stayed with relations at Havre, and then being sufficiently recovered, he joined an elder brother in business in New York. Once more sickness threw him out of the career he had chosen, and, after a long sea voyage which restored his health, he paid a visit to his native land, and there formed the connection which decided the course of his life.

Agénor Boissier had been his schoolfellow at Geneva, and Barbey now became acquainted with Agénor's brother Edmund, the botanist, into whose circle he was drawn, and it was not long before intimate ties united him with the family, for in 1869 he married Edmund's daughter Caroline. Boissier initiated Barbey into botany, and it was he who instilled into him that taste for field work and for experimental gardening which animated him throughout the rest of his life.

The field of Boissier's activity concerned two great sections of the Mediterranean region—Southern Spain and the "Orient." Barbey's work just touched the West—he translated Hooker's letters* on Marocco and published (together with Burnat) "Notes sur un voyage dans les îles Baléares" (1882). His main work formed a connection with and a development of the "Flora Orientalis," as is indicated by the titles of such publications as "Herborisations au Levant" (1882), "Lydie, Lycie, Carie" (1890), "Samos" (1893), "Karpathos" (1895), "Sertum Cerigense" (1897). The publication of his "Florae Sardoae Compendium" (1884) and his share in the "Florae Libycae Prodromus" (1910) also bridged to some extent the wide gap between the principal domains of Boissier's life work.

Barbey went twice to the Orient; in 1873 he travelled through Greece to Smyrna, Constantinople and the Bithynian Olympus, and in 1880 he visited Egypt, Palestine, Western Syria and Cyprus. In order to supplement the material collected on his

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* In Proceed. R. Geogr. Soc. London (1871) xv, pp. 212–221.

own journeys he frequently employed collectors in the East, among whom may be mentioned Adolf Pichler in Karpathos, Lycia and Cyprus, the noted palaeontologist C. T. Forsyth Major in Karpathos, Samos, and other islands of the Aegean Sea, and Philipp Taubert in the Cyrenaica. He also furthered the botanical exploration of the Orient with financial assistance and opened the pages of the "Bulletin de l'Herbier Boissier" to papers on the Oriental flora. A number of articles, mainly plant lists of certain Aegean islands, published in the Bulletin were the result of the joint work of Barbey and Major, whilst the fruits of Taubert's expedition were incorporated in that fine work "Florae Libycae Prodromus," which was begun by Barbey in co-operation with Ascherson and finished by Durand and Baratte, with Barbey still acting as co-editor.

In 1871 Barbey began a monograph of the genus *Epilobium*, for the illustration of which he secured the services of Ch. Cuisin. The publication of the work was delayed from year to year until Barbey, in 1884, saw himself forestalled by the appearance of Haussknecht's monograph. Fortunately 24 beautiful plates were ready and, accompanied by a short diagnostic text, they were issued as a separate volume in 1885.

In the same year Edmund Boissier died. It was only natural that the mantle of the great phytographer should fall on Barbey, but in wise recognition of his powers and abilities he preferred to establish himself as the guardian of the legacy which Boissier had left to the botanical world, and in this he has earned the gratitude of the disciples of our science even more than by his botanical publications. Under the will of Dr. Pierre Butini, Boissier's father-in-law, the house containing Boissier's herbarium and library became, after Boissier's death, the property of the city of Geneva. The question of finding a new home for the collections became therefore urgent, and it was settled, almost at once, by the acquisition of a convenient site and the erection of an adequate building not far from Boissier's old house at Chambésy. Two years later (1887) the new "Herbier Boissier" was opened under the curatorship of E. Autran. Barbey continued to augment the collections with great liberality, and at the same time placed them with equal generosity at the disposal of all botanists. No one who has enjoyed the hospitality of the charming herbarium at Chambésy will ever forget the debt of gratitude which he owes to the memory of the two generous and public-spirited men who have created and preserved this refugium of botanical science and set it in a spot of such rare natural beauty.

Barbey's zeal, however, did not stop there, for in 1893 he founded the "Bulletin de l'Herbier Boissier," which he carried on at his own expense until December, 1908. It is unnecessary to dilate on the value of this publication, which was open practically to the whole of the botanical world, and its cessation is a matter of great regret. Another venture of Barbey's, conceived in his usual endeavour to serve the general good, had an even shorter life, namely, the publication of an "Index botanique universel," a card catalogue of all the new species of vascular plants of the Old World published after 1900. The fault was not his; had the enterprise been supported in the spirit in which it was

started, it would no doubt have won the day and become self-supporting.

The death of William Barbey is a great loss not only to botanical science, but also to his country. It means the loss of an independent and true patriot, of a liberal supporter of public institutions, and in narrower circles of a genuine friend of local botanical exploration and a patron of skilled gardening.

The memory of William Barbey still lives, like that of his father-in-law, in the Herbarium at Chambésy, and it is hoped that, through the generosity of his family, it may long remain a symbol of filial piety, enlightened citizenship and that wider humanity which stretches across political frontiers and binds us all in our common heritage of knowledge.†

Kew and the War.—Seventy-seven members of the Kew staff are now serving with His Majesty's forces on land and sea. Since the publication of the last note eleven more men have volunteered their services, of whom six are sub-foremen. Three young gardeners, the motor-mower driver and one of the labourers make up the number.

Sylviculture in the Tropics.*—Sylviculture in temperate regions has a considerable literature, containing of course much that is applicable to tropical conditions; but there was a need for a handy practical volume designed especially for the use of the forester in the Tropics. This need has been met by Mr. Broun, whose experience in the Indian Forest Service, afterwards as Conservator of Forests in Ceylon, and finally as Director of Woods and Forests under the Sudan Government, has well equipped him for a work of the kind. The book is written in simple lucid language, and well illustrated by photographs of trees or forest scenes and by woodcuts of sylvicultural implements, &c.

The work is divided into four parts of which the first is practically an article on forest ecology, based largely, as the author acknowledges, on Schimper's *Plant Geography*, and on Dr. Russell's article, *The Soil and the Plant*, published in *Science Progress* for July, 1911. The second part deals with the Formation and Regeneration of Woodland Crops; the third with the Training and Improvement of Forests; and the fourth with Special Measures of Maintenance and Protection, terminating with an interesting and useful chapter on the Fixation of shifting sands and of unstable slopes.

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† Our thanks are due to M. Gustave Beauverd, the able Curator of the Boissier Herbarium, for allowing us to read the proof of Prof. Chodat's forthcoming biographical sketch of William Barbey, on which this note has been largely based.

* Sylviculture in the Tropics. by A. F. Broun. London: Macmillan & Co., Ltd., 1912, 8vo., pp. xviii and 309, with 96 text figures. Price 8s. 6d.
